

The invention having been described, We claim,

1           1. A coupling assembly for connecting, as an axially serial continuation, a  
2 down hole motor rotor to the down hole motor output shaft, the coupling assembly  
3 comprising:

4           a) a first flexible coupling, having lubricant space therein, arranged for  
5 connection, at a first end, to the output shaft;

6           b) a second flexible coupling, having lubricant space therein, arranged for  
7 connection at a third end to the first coupling and arranged, at a fourth end arranged  
8 for connection to the motor rotor;

9           c) a first flexible seal situated in the first flexible coupling, arranged to  
10 function as a closure for the lubricant space between the first and second ends, the  
11 seal comprising a first metal sleeve sealingly and peripherally attached to one end of  
12 the first coupling, a first elastomer sleeve sealingly and peripherally attached at one  
13 end to the distal end of the first metal sleeve and sealingly and peripherally attached  
14 at the other end to the other end of the first flexible coupling;

15           d) a second flexible seal situated in the second flexible coupling, arranged to  
16 function as a closure for space between the third and fourth ends, the seal  
17 comprising a second metal sleeve sealingly and peripherally attached to one end of  
18 the first coupling, an second elastomer sleeve peripherally attached at one end to the  
19 distal end of the second metal sleeve and sealingly peripherally attached at the other  
20 end to the other end of the second flexible coupling;

21           e) at least one variable volume lubricant reservoir in the assembly and arranged  
22 with fluid channels to provide lubricant to at least one of the un-occupied spaces of  
23 at least one of the couplings.

1           2. The coupling assembly of claim 1 wherein the variable volume reservoir  
2 comprises two variable volume reservoirs, each variable volume reservoir arranged  
3 to supply lubricant to a different one of the two couplings.

3. The coupling assembly of claim 1 wherein each elastomer sleeve is bonded  
to its related metal sleeve.

4. The coupling assembly of claim 1 wherein each elastomer sleeve is attached  
to the other end of the related flexible coupling by a retaining peripheral band.

5. The coupling assembly of claim 1 wherein the flexible sleeve is attached to  
the metal sleeve by radial force exerted by an internal peripherally expanded band.

1           6. The coupling assembly of claim 1 wherein the elastomer sleeve is related to  
2 mounting provisions such that, when the related coupling is straight, the elastomer  
3 sleeve is in initial axial tension.

1           7. The coupling assembly of claim 1 wherein the elastomer sleeve is related to  
2 mounting provisions such that, when the related coupling is straight, the elastomer  
3 sleeve is in initial axial compression.

1           8. The coupling assembly of claim 1 wherein the elastomer sleeve is provided  
2 with a security ring expanded inside the elastomer sleeve to urge it against the  
3 related metal sleeve.

1           9. A down hole motor flexible coupling for use as an axially serial coupling  
2 between the down hole motor rotor and the output shaft of the down hole motor, the  
3 flexible coupling comprising:

4           a) a first coupling portion, having a first axis, with first abutment surfaces  
5 arranged to deliver rotational force about the first axis;

6           b) a second coupling portion, having a second axis, with second abutment  
7 surfaces to deliver rotational forces to the first abutment surfaces to transmit torque  
8 along the axes which are mutual extensions;

9           c) lubricant channels, between the portions, arranged to provide lubricant to  
10 the abutment surfaces;

11           d) a hermetic seal providing closure between the two portions, the seal  
12 comprising;

13           e) a metal sleeve sealingly attached to the outer surface of one portion and  
14 extending axially toward the other portion;

15           f) an elastomer sleeve sealingly attached to the metal sleeve and extending  
16 axially toward the other sleeve and sealingly clamped peripherally at the distal end  
17 to the other portion;

18           g) a variable volume lubricant reservoir in one portion with fluid channels  
19 providing lubricant communication to the lubricant channels;

20           h) the hermetic seal providing closure between the two portions.

1           10. The down hole motor flexible coupling according to claim 9 wherein an  
2 annular ring is situated inside the elastomer sleeve and expanded therein to provide  
3 radial compression to the inner surface of the elastomer sleeve to urge it against the  
4 inner surface of the metal sleeve.

1           11. The down hole motor flexible coupling according to claim 9 wherein the  
2 elastomer sleeve is sealingly clamped to the other portion by a band situated on the  
3 outer surface of the elastomer sleeve to secure it to the other portion.

1           12. A sealed coupling assembly for connecting, as an axially serial  
2 continuation, a down hole motor rotor to the down hole motor output shaft, the  
3 coupling assembly comprising:

4           a) a first flexible coupling, having lubricant space therein, arranged for  
5 connection, at a first end, to the output shaft;

6           b) a second flexible coupling, having lubricant space therein, arranged for  
7 connection at a third end to the first coupling and arranged, at a fourth end arranged  
8 for connection to the motor rotor;

9           c) a first flexible seal situated in the first flexible coupling, arranged to  
10 function as a closure for the lubricant space between the first and second ends, the  
11 seal comprising a first metal sleeve sealingly and peripherally attached to one end of  
12 the first coupling, a first flexible sleeve sealingly and peripherally attached at one end  
13 to the distal end of the first metal sleeve and sealingly and peripherally attached at  
14 the other end to a second metal sleeve which is sealingly attached to the other end  
15 of the first flexible coupling;

16           d) a second flexible seal situated in the second flexible coupling, arranged to  
17 function as a closure for space between the third and fourth ends, the seal  
18 comprising a third metal sleeve sealingly and peripherally attached to one end of the  
19 first coupling, an second flexible sleeve peripherally attached at one end to the distal  
20 end of the third metal sleeve and sealingly peripherally attached at the other end to  
21 a fourth metal sleeve which is sealingly attached to the other end of the second  
22 flexible coupling;

23           e) at least one variable volume lubricant reservoir in the assembly and arranged  
24 with fluid channels to provide lubricant to at least one of the un-occupied spaces of  
25 at least one of the couplings.

13. The coupling assembly of claim 12 wherein said flexible sleeves are convoluted bellows.

14. The coupling assembly of claim 13 wherein said convoluted bellows are supported internally by at least one hoop inside at least one convolution.

15. The coupling assembly of claim 13 wherein said convoluted bellows is radially restrained by at least one band on the outside of at least one convolution.

16. The coupling assembly of claim 13 wherein said convoluted bellows is of metal construction.

1 17. The coupling assembly of claim 13 wherein said convoluted bellows are  
2 radially supported by a wear ring situated on the inside of at least one said  
3 convolution.